

Claims

1. A method for controlling optical power in a monitoring device intended for determining the amount of at least one light absorbing substance
5 in a subject, the monitoring device comprising
- emitters for emitting radiation at a minimum of two wavelengths,
 - driving means for activating said emitters, and
 - a detector for receiving said radiation at said wavelengths and for producing an electrical signal in response to the radiation,
- 10 the method comprising the steps of
- supplying driving pulses from said driving means to the emitters, the pulses having predetermined characteristics determining the optical power of the device,
 - demodulating the electrical signal originating from said detector,
- 15 whereby a baseband signal is obtained,
- monitoring a signal-to-noise ratio of the baseband signal, and
 - controlling the duty cycle of the driving pulses in dependence on the monitored signal-to-noise ratio.
2. A method according to claim 1, wherein said controlling step
20 includes controlling the duty cycle of the driving pulses so that the optical power is minimized within the confines of a predetermined lower threshold set for the signal-to-noise ratio.
3. A method according to claim 2, wherein said controlling step further includes comparing the monitored signal-to-noise ratio to said predetermined
25 lower threshold and to a predetermined higher threshold.
4. A method according to claim 3, further including the step of connecting the electrical signal originating from said detector through a preamplifier and a low-pass-filter prior to said demodulating step.
5. A method according to claim 4, wherein said controlling step
30 includes
- performing at least one operation in response to said signal-to-noise-ratio reaching said lower threshold, the said at least one operation being selected from a group of operations including (1) the increase of the width of said pulses and (2) the increase of pulse repetition rate, and
- 35 - decreasing the bandwidth of said low-pass filter when the width of said pulses is increased.
6. A method according to claim 5, wherein the controlling step further

includes the step of increasing the amplitude of said driving pulses.

7. A method according to claim 4, wherein said controlling step includes

5 - selecting at least one operation in response to said signal-to-noise-ratio reaching said higher threshold, the said at least one operation being selected from a group of operations including (1) the decrease of the width of said pulses and (2) the decrease of pulse repetition rate, and

 - increasing the bandwidth of said low-pass filter when the width of said pulses is decreased.

10 8. A method according to claim 7, wherein the controlling step further includes the step of decreasing the amplitude of said driving pulses.

 9. A method according to claim 1, wherein said demodulating step includes sampling of the electrical signal by a synchronous detector, taking one sample per each pulse of the electrical signal.

15 10. A method according to claim 1, wherein the amount of at least one light absorbing substance is determined in the blood of a subject.

 11. A method according to claim 1, wherein the monitoring device is a pulse oximeter.

20 12. An apparatus for non-invasively determining the amount of at least one light absorbing substance in a subject, the apparatus comprising

 - emitters for emitting radiation at a minimum of two different wavelengths,

 - driving means for activating said emitters, adapted to supply driving pulses to the emitters, the pulses having predetermined characteristics
25 determining current optical power of the device,

 - a detector for receiving said radiation at said wavelengths and producing an electrical signal in response to the radiation,

 - a demodulator unit for demodulating the electrical signal originating from said detector, whereby a baseband signal is obtained from the
30 demodulator unit,

 - monitoring means for monitoring signal-to-noise ratio of the baseband signal, and

 - power control means, responsive to the monitoring means, for controlling the duty cycle of the driving pulses.

35 13. An apparatus according to claim 12, wherein the power control means are adapted to control the duty cycle so that the optical power is minimized within the confines of a predetermined lower threshold set for the

signal-to-noise ratio.

5 14. An apparatus according to claim 13, further comprising a low-pass filter for filtering said electrical signal prior to said demodulating, the control means comprising at least one set of first and second means, wherein the first means are adapted to change the width of said pulses and of the passband of the low-pass filter, and the second means are adapted to increase pulse repetition rate.

 15. An apparatus according to claim 14, wherein the control means further comprise means for changing the amplitude of said pulses.

10 16. An apparatus according to claim 13, said apparatus being a non-invasive monitoring device, preferably a pulse oximeter.